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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/667,651	09/22/2000	H. Vincent Poor	24,338A USA	1160

7590 06/17/2004

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EXAMINER	
PERILLA, JASON M	
ART UNIT	**PAPER NUMBER**
2634	7

DATE MAILED: 06/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/667,651	POOR ET AL.	
	Examiner	Art Unit	
	Jason M Perilla	2634	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 April 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9, 11, 13-21, 23, and 25-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9, 11, 13-21, 23, and 25-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *22 September 2000* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-9, 11, 13-21, 23, and 25-26 are pending in the instant application.

Response to Amendment/Argument

2. The rejections of claims 10-12, and 22-24 under 35 USC § 112 have been withdrawn in view of the amendments to the claims.

3. Applicant's arguments, see page 13, filed April 5, 2004, with respect to the prior art rejections incorporating Nowak (5903826) have been fully considered and are persuasive. The art rejections of the first office action dated December 4, 2003 have been withdrawn because the prior art reference Nowak does not disclose a beamforming circuit as claimed in the instant application.

However, new art rejections have been made.

Claim Objections

4. Claim 11 is dependent upon claim 10 although it should be dependent upon claim 25 to maintain consistency after the amendment of April 5, 2004.

5. Claim 23 is dependent upon claim 22 although it should be dependent upon claim 26 to maintain consistency after the amendment of April 5, 2004.

6. Claim 13 recites the limitation "said beamforming circuit" in line 9. There is insufficient antecedent basis for this limitation in the claim.

7. Regarding claims 25 and 26, the value "$P_{G-1|G-1}(F_{G-1})$" should be consistent between lines 4 and 14 in each claim.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

9. Claims 1 and 13 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Regarding claims 1 and 13, the claims are not enabled because the weighing and combining of the outputs of N antenna receiving elements is claimed as being dependent upon a beam scheduling sequence although the generation of the beam scheduling sequence is independent of the generation of a single beam according to the combining of the outputs of the antenna array as described in the specification. The claims are not enabled because the generation of a single beam according to the specification is based upon the combination of the outputs from the antenna array only rather than being based upon the beam scheduling sequence as well. One skilled in the art is not enabled to create a single beam by the beamforming circuit according to the beam scheduling sequence. *While the sequence of the generated beams may be enabled according to the beam scheduling sequence, the weighting and combining of the antenna array to create a single beam according to the beam sequence is not.*

10. Claims 4 and 16 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for switching at a rate faster than the data rate or as fast as "the chip rate", does not reasonably provide enablement for switching at a rate

faster than the chip rate. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention commensurate in scope with these claims.

Regarding claims 4 and 16, the specification does not enable one skilled in the art to switch beams by a beamforming circuit at infinitely fast speeds. Indeed, the claimed limitation necessarily includes that which is impossible to achieve being an infinitely fast switching of beams according to a beam scheduling sequence. There is no matter of an amount experimentation to consider regarding the enablement of the claims. Because the claim language of "faster than a data rate" includes any speed that is faster than a data rate, it is including all switching speeds of the beams faster than that of the data rate including an infinitely fast rate which can not be enabled by any disclosure because it is not possible to achieve.

11. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

12. Claims 25 and 26 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claims 25 and 26, the parameters and arguments of the equations set forth on line 4 of each claim are not properly defined. Hence, the claims are found to be indefinite because one skilled in the art is unable to determine the meaning of the terms in the equations by the claim alone. All of the terms and arguments of the equation must be defined in the claim. Any notation used that is not common to one of ordinary

skill in the art must also be defined so that one can understand the meaning of the claim without reference to the specification. The function "$\arg_{FG-1}\max Tr$" should be defined.

Claim Rejections - 35 USC § 103

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

14. Claims 1-2, and 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted the prior art as shown in figure 1 in view of Kuwahara et al (US 6141335; hereafter "Kuwahara").

Regarding claim 1, the admitted prior art according to figure 1 discloses an apparatus for performing beamforming on a plurality of signals in a reception channel received from a receiving antenna array (pgs. 2-7, "background of the invention"; ref. 12) the signals including simultaneous data signals from a plurality of transmitters, an Nx1 switched beamforming circuit (pg. 4; fig. 1, ref. 14) for weighting and combining outputs of N antenna receiving elements and generating a single beam therefrom, wherein N is an integer greater than 1, a frequency downconverting circuit (pg. 5; fig. 1, ref. 16) for converting the beam signal to baseband, and a multi-path/multi-user estimation circuit for generating path estimates and path estimate errors for each of the multiple simultaneous transmitters from the baseband beam signal (pg. 5; fig. 1, ref. 20). The admitted prior art discloses the common use of a beamforming antenna array (refs. 12, 14). The admitted prior art does not disclose a beam scheduling sequence or a

beam schedule generating circuit for generating the beam scheduling sequence for switching between ones of a plurality of beams for generation by the beamforming circuit. However, Kuwahara teaches a beam schedule generating circuit (fig. 4, ref. 8; fig. 5, ref. 8) and the generation of a beam scheduling sequence (figs. 4 and 5; col. 3, lines 10-20; col. 4, lines 55-56). Kuwahara teaches that by switching the plurality of beams, the subscriber's capacity can be increased (col. 3, lines 20-34). Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize the beam schedule generating circuit generating the beam scheduling sequence as taught by Kuwahara et al in the apparatus of the admitted prior art because it could be used to increase a subscribers capacity.

Regarding claim 2, the admitted prior art in view of Kuwahara discloses the limitations of claim 1 as applied above. Further, the admitted prior art as shown in figure 2 further shows an analog-to-digital converter (ref. 18) between the frequency downconverting circuit and the multi-path/multi-user estimation circuit wherein the multi-path/multi-user estimation circuit comprises a digital signal processor (pg. 5, lines 21-26).

Regarding claim 13, the admitted prior art as shown in figure 1 discloses a method for performing beamforming on a plurality of signals in a reception channel received from a receiving antenna array including simultaneous data signals from a plurality of transmitters (pgs. 2-7, "background of the invention") comprising, weighting and combining outputs of N antenna receiving elements and generating a single beam therefrom wherein N is an integer greater than 1 (pg. 4; fig. 1, ref. 14), converting beam

signal to baseband (pg. 5; fig. 1, ref. 16), and generating path estimates and path estimate errors for each of the multiple simultaneous transmitters from the baseband beam signal (fig. 1, ref. 20). The admitted prior art does not disclose generating a beam scheduling sequence for switching between ones of a plurality of beams for generation by the beamforming circuit. However, Kuwahara teaches a beam schedule generating circuit (fig. 4, ref. 8; fig. 5, ref. 8) and the generation of a beam scheduling sequence (figs. 4 and 5; col. 3, lines 10-20; col. 4, lines 55-56). Kuwahara teaches that by switching the plurality of beams, the subscriber's capacity can be increased (col. 3, lines 20-34). Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize the beam schedule generating circuit generating the beam scheduling sequence as taught by Kuwahara et al in the method of the admitted prior art because it could be used to increase a subscribers capacity.

Regarding claim 14, the admitted prior art in view of Kuwahara discloses the limitations of claim 13 as applied above. Further, the admitted prior art as shown in figure 2 further shows an analog-to-digital converter (ref. 18) between the frequency downconverting circuit (3) and the multi-path/multi-user estimation circuit (4).

15. Claims 3-9, and 15-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted the prior art as shown in figure 1 in view of Kuwahara, and in further view of Chang et al (Communications, 1999. ICC '99. 1999 IEEE International Conference on; page(s): 1588-1592 vol. 3)

Regarding claim 3, the prior art in view of Kuwahara describes the limitations of claim 2 as applied above. However, the prior art in view of Kuwahara does not disclose

that the schedule generating circuit is adapted to generate the beam scheduling sequence by determining a minimum mean square error estimation of a state-space model of the reception channel. However, Chang et al teach the use of least mean square (LMS) or minimum mean squared error, normalized least mean square error (NLMS), and recursive least square (RLS) methods for adaptive beamforming (pg. 1590, col. 1, lines 35-40). The use of a minimum mean squared error estimation of a state-space model of the reception channel is commonly known in the art because it leads to correct symbol decisions. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize the minimum mean squared estimation of a state space model of the reception channel as taught by Chang et al in the beamforming system as disclosed by the admitted prior art in view of Kuwahara because it would provide for better symbol decisions even when interference is found in the receiving channel.

Regarding claim 4, the admitted prior art in view of Kuwahara and in further view of Chang et al discloses the limitations of claim 3 as applied above. Further, Kuwahara discloses that the pilot beam is switched at a rate as fast as the chip rate (col. 7, lines 10-25). One skilled in the art is familiar with the fact that the chip rate is ultimately faster than the data rate. Therefore, Kuwahara discloses that the beams are switched at a rate faster than that of the data rate of the communications system.

Regarding claim 5, the admitted prior art in view of Kuwahara and in further view of Chang et al discloses the limitations of claim 3 as applied above. Further, Kuwahara

discloses that the pilot beam is switched at a rate as fast as the chip rate (col. 7, lines 10-25).

Regarding claim 4, the admitted prior art in view of Kuwahara and in further view of Chang et al discloses the limitations of claim 3 as applied above. Further Chang et al discloses switching the selected antenna beam at a rate faster than a data rate of the signals in the reception channel. Chang et al discloses chip-level beamforming (pg. 1588, col. 2, lines 17-20) meaning that the beams are switched on a chip by chip basis. One skilled in the art understands that the chip rate is sufficiently faster than the data rate. Because Chang et al discloses switching the antenna at the chip rate, this leads to the beam schedule generating circuit switching at the selected beam at a rate faster than a data rate.

Regarding claim 5, the admitted prior art in view of Kuwahara and in further view of Chang et al discloses the limitations of claim 3 as applied above. The admitted prior art in view of both Kuwahara and Chang et al disclose that the beamforming apparatus is configured to receive a spread spectrum signal. Chang et al discloses CDMA reception as well in the introduction. It is well known to one skilled in the art that a CDMA signal is a direct sequence spread spectrum signal having a chip rate. Further, Chang et al discloses chip-level beamforming (col. 2, lines 17-20) meaning that the beams are switched on a chip by chip basis.

Regarding claim 6, the admitted prior art in view of Kuwahara and in further view of Chang et al discloses the limitations of claim 5 as applied above. Further, the admitted prior art and Chang et al disclose that the beamforming apparatus is

configured to receive a spread spectrum signal. Chang et al discloses the reception of a CDMA signal in the introduction. One skilled in the art is familiar with spread spectrum CDMA signals, and it would have been obvious for one having ordinary skill in the art to utilize a CMDA signal.

Regarding claim 7, the admitted prior art in view of Kuwahara and in further view of Chang et al disclose the limitations of claim 6 as applied above. Further, it is well known in the art that CDMA signals are direct sequence spread spectrum (DSSS) modulated signals. Chang et al discloses that the CDMA signals are DS-CDMA signals (pg. 1591, col. 2, line 13) or direct sequence CDMA signals.

Regarding claim 8, the admitted prior art in view of Kuwahara and in further view of Chang et al discloses the limitations of claim 4 as applied above. Further Kuwahara discloses that the beam schedule generating circuit revises the beam scheduling sequence at predetermined intervals and said beam schedule generating circuit controlling said beamforming circuit in accordance with repetitions of a given beam scheduling sequence until revised (col. 7, lines 28-40).

Regarding claim 9, the admitted prior art in view of Kuwahara and in further view of Chang et al discloses the limitations of claim 8 as applied above. Further Kuwahara discloses a base station controller or beam schedule generating circuit (fig. 5, ref. 8) for scheduling the beam sequence (col. 7, lines 38-49) which inherently contains a memory. It is inherent that all microcontrollers contain a form of memory for their operation and utility. One skilled in the art is very familiar with the use of a memory in a controller. While it is inherent that the generation of a beam sequence by a

microcontroller must use a type of memory in the generation of the sequence, it is obvious that the beam schedule sequence would be stored in a memory so that the beam schedule generating circuit could store each beam scheduling sequence in the memory and retrieve the beam scheduling sequence from the memory to be used for controlling the beamforming circuit during the interval of its use.

Regarding claim 15, the prior art in view of Kuwahara describes the limitations of claim 14 as applied above. However, the prior art in view of Kuwahara do not disclose that step (2) above generates the beam scheduling sequence by determining a minimum mean square error estimation of a state-space model of the reception channel. However, Chang et al teach the use of least mean square (LMS) or minimum mean squared error, normalized least mean square error (NLMS), and recursive least square (RLS) methods for adaptive beamforming (pg. 1590, col. 1, lines 35-40). The use of a minimum mean squared error estimation of a state-space model of the reception channel is commonly known in the art because it leads to correct symbol decisions. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize the minimum mean squared estimation of a state space model of the reception channel as taught by Chang et al in the beamforming system as disclosed by the admitted prior art in view of Kuwahara because it would provide for better symbol decisions even when interference is found in the receiving channel.

Regarding claim 16, the admitted prior art in view of Kuwahara and in further view of Chang et al discloses the limitations of claim 15 as applied above. Further

Chang et al discloses the method of step (2) above wherein the selected beam rate is switched at a rate faster than a data rate of the signals in the reception channel. Chang et al discloses chip-level beamforming (pg. 1588, col. 2, lines 17-20) meaning that the beams are switched on a chip by chip basis. One skilled in the art understands that the chip rate is sufficiently faster than the data rate. Because Chang et al discloses switching the beams at the chip rate, this leads to the beam schedule generating circuit switching at a rate faster than the data rate of the reception signals.

Regarding claim 17, the admitted prior art in view of Kuwahara and in further view of Chang et al discloses the limitations of claim 15 as applied above. The admitted prior art in view of both Kuwahara and Chang et al disclose that the beamforming apparatus is configured to receive a spread spectrum signal. Kuwahara notes the reception of code division multiple access (CDMA) signals (col. 7, line 11) and Chang et al discloses CDMA reception as well in the introduction. It is well known to one skilled in the art that a CDMA signal is a direct sequence spread spectrum signal having a chip rate. Further, Chang et al discloses chip-level beamforming (col. 2, lines 17-20) meaning that the beams are switched on a chip by chip basis. Because Chang et al discloses switching the antenna at the chip rate, this leads to step (2) above wherein step (2) comprises switching the selected beam at the chip rate.

Regarding claim 18, the admitted prior art in view of Kuwahara and in further view of Chang et al discloses the limitations of claim 17 as applied above. Further, Kuwahara and Chang et al disclose that the beamforming method is configured to

receive a spread spectrum signal. Kuwahara notes the reception of CDMA signals (col. 7, line 11) and Chang et al discloses CDMA reception as well in the introduction.

Regarding claim 19, the admitted prior art in view of Kuwahara and in further view of Chang et al discloses the limitations of claim 18 as applied above. Further, Kuwahara and Chang et al disclose that the beamforming method is configured to receive a spread spectrum signal. Kuwahara notes the reception of DS/CDMA signals (col. 8, line 8) and Chang et al discloses CDMA reception as well in the introduction. It is well known in the art that CDMA signals are direct sequence spread spectrum (DSSS) modulated signals. Chang et al discloses that the CDMA signals are DS-CDMA signals (pg. 1591, col. 2, line 13) or direct sequence CDMA signals.

Regarding claim 20, the admitted prior art in view of Kuwahara and in further view of Chang et al discloses the limitations of claim 16 as applied above. Further Kuwahara discloses that the beam schedule generating circuit revises the beam scheduling sequence at predetermined intervals and said beam schedule generating circuit controlling said beamforming circuit in accordance with repetitions of a given beam scheduling sequence until revised (col. 7, lines 28-40).

Regarding claim 21the admitted prior art in view of Kuwahara and in further view of Chang et al discloses the limitations of claim 20s applied above. Further Kuwahara discloses a base station controller or beam schedule generating circuit (fig. 5, ref. 8) for scheduling the beam sequence (col. 7, lines 38-49) which inherently contains a memory. It is inherent that all microcontrollers contain a form of memory for their operation and utility. One skilled in the art is very familiar with the use of a memory in a

controller. While it is inherent that the generation of a beam sequence by a microcontroller must use a type of memory in the generation of the sequence, it is obvious that the beam schedule sequence would be stored in a memory so that the beam schedule generating circuit could store each beam scheduling sequence in the memory and retrieve the beam scheduling sequence from the memory to be used for controlling the beamforming circuit during the interval of its use.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M Perilla whose telephone number is (703) 305-0374. The examiner can normally be reached on M-F 8-5 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Chin can be reached on (703) 305-4714. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jason M. Perilla
June 9, 2004

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jmp